BI

Appln. No. 09/508,322

- 2 -

May 12, 2000

units of copper to 1 unit of the [one or more] hard carbide forming metals.

REMARKS

The above amendments are made to conform the application to the amendments made prior to the international preliminary examination. The International Preliminary Examination Report dated November 16, 1999 is enclosed.

Respectfully submitted,

SYNNESTVEDT & LECHNER LLP

D.,,

Charles H. Lindrooth

Reg. No. 20,659

1101 Market Street, Suite 2600 Philadelphia, PA 19107-2950 Telephone: (215) 923-4466 Facsimile: (215) 923-2189

CHL/dml Enclosure

M:\DLarsen\DRURY\23815THIRD.AMD

INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To.

DRURY, Peter, Lawrence T & N Limited

Manchester International Office Can

Styal Road

Manchester M22-5TN

GRANDE BRETAGNE

International application No

PCT/GB98/02526

30 gat: 44 7 7888 4 6222

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY **EXAMINATION REPORT**

(PCT Rule 71.1)

Otto of mailing (day/month/yea/) 1619

Applicant's or agent's No reterance

TNT 2621

IMPORTANT NOTERCATION

International tiling date (day/month/year) 21/08/1998

Priority data (day/month/year) 09/09/1997

Applicant

FEDERAL-MOGUL TECHNOLOGY LIMITED at AL.

Peterce: your letter dakd 21.02.2000.

 The applicant is hereby notified that this international Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application. Enclosed please find copy of sper muit mas 16. 11. 1995. Se-1 ou

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices. さ

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexas) and will transmit such translation to those Offices. MAIL 3

4. REMINDER

BEST AVAILABLE COPY

The applicant must enter the national phase before each elected Office by performing certain acts (filling): translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the international Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume Ili of the PCT Applicant's Guide.

Name and maring address of the IPEA/

Authorizad offices

European Patent Office D-80298 Munich

Jablanovski, H

Tel. +49 69 2389 - 0 Tx. 523856 epmu d Fear +49789 2599 -4485

Tel.+49 89 2399-2681

Form PCT/IPEA/416 (July 1992)

HJ20958, 10 11,1899

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	See Notification of Transmittal of International FOR FURTHER ACTION Preliminary Examination Report (Form PCT/IPEA/418)						
TNT 2621							
international application No.	International filing date (day/month/year)	Priority date (day/month/year)					
PCT/GB98/02526 21/08/1998 09/09/1997							
International Patent Classification (IPC) of C22C37/00	national classification and IPC	·					
Applicant FEDERAL-MOGUL TECHNOLO	GY I IMITED et al.						
		10 Harings Evening Authority					
and is transmitted to the applica	ant according to Article 36.	his International Preliminary Examining Authority					
2. This REPORT consists of a tot	al of 5 sheets, including this cover sheet.						
	on 607 of the Administrative Instructions L	scription, claims and/or drawings which have ining rectifications made before this Authority under the PCT).					
		ROO					
3. This report contains indication	s relating to the following Items:	*					
Basis of the repo	rt.	}					
u 🗖 Briorite							
III □ Non-establishme	oncy n-establishment of opinion with regard to novelty, inventive step and industrial applicability						
I location of the	augnting.	i					
U St Consend states	nent under Article 35(2) with regard to nov planations suporting such statement	relly, inventive step or industrial applicability:					
VI Certain docume							
VII Certain defects I	n the international application						
Vijil 🖾 Certain observa	tions on the international application	, TC 171					
		- 5 5 17					
Date of submission of the demand	Date of cor	mpleban of this report 1 6 11 9 RO ROLL ROLL ROLL ROLL ROLL ROLL ROLL					
11/03/1999							
Name and mailing address of the interpretation preliminary examining authority: European Patent Office	i	1 officer					
0-80298 Munich Tel. +49 89 2399 - 0 T	x: 523655 epmu d	(, G e No. +49 89 2399 6445					

been

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB98/02526

1.	Basis	of	the	report
----	-------	----	-----	--------

ichad to the receiving Office in 1.

	report has been draw conse to an invitation report since they do I	HAMBE ACICIE 14	ale ioici	,00 10	have been fumisf of as "originally file	ned to the raceiving Unit of and are not annexed
Des	cription, pages:					
1,3-	6 a	s originally filed	ŧ			
2	ē	as received on		08/10/1999	with letter of	06/01/1999
Cla	ims, No.:					
7		as originally filed				
1-6	6	as received on		08/10/1999	9 with letter of	06/01/1999
2. Th	the claims. the drawings.	pages: Nos.: sheets:				and since they have
3. E	This report has be considered to go considered to go	peyona the disc	iosure as	filed (Rule 70.2(d	e)):	n made, since they have
v.	Reasoned statemer applicability; citation	nt under Article one and explan	e 35(2) wi ations su	th regard to nove pporting such s	elty, inventive ste talement	p or Industrial
1.	Statement				•	
	Novelty (N)	Yes: No:	Claims Claims	1-7		
	Inventive step (IS)	Yes: No:	Claims Claims	1-7		
	Industrial applicabil	lity (IA) Yes: No:	Claims Claims	1-7		

INTERNATIONAL PRELIMINARY **EXAMINATION REPORT**

International application No. PCT/GB98/02526

2. Citations and explanations

see separate sheat

Vill. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

INTERNATIONAL PRELIMINARY

International application No. PCT/GB98/02526

EXAMINATION REPORT - SEPARATE SHEET

Amendments Art.34(2b) 1.

The amended claims and page 2 of the description are considered to be based upon subject matter which was disclosed in the originally filed documents.

Clarity, Art.6 PCT <u>2</u>,

2.1. The phrase "..carbide forming metals.." in claim 1 is unclear. It neither gives an indication as to which metals could be considered as carbide forming, nor does the description give any indication as to the propensity of a metal to form a carbide. This will depend upon many factors other than the metals present, such as the carbon content and the cooling rate from the melt.

The objection could be overcome by listing the carbide forming metals, excluding vanadium and titanium, as tungsten, chromium, molybdenum and niobium. Claim 2 is in this respect not limiting since it refers to the phrase " also including". An allowable phrase would be to replace it with "consisting".

2.2. It would also appear from the description that the feature of "the vanadium must be equal or less than half the copper added to twenty times the titanium content" is essential to the invention, in particular in achieving the wear resistance of the rotor, (cf. page 3, middle and page 4, penultimate paragraph). The omission of this apparently essential feature results in a lack of clarity to the extent that the aims of the invention may not be achieved.

Novelty. Art.33(2) 3.

None of the documents cited in the International Search Report discloses a disc brake rotor with the compositional limitations given in claim 1. The disc brake rotor of claim 1 is novel.

The closest prior art is considered to be JP-A-2 138 438 which discloses rotors for disc brakes with good wear properties, high strength, good damping properties and good resistance to thermal cracking. The rotor is made of grey cast iron containing 0.20-2.0 wt.% Cu, 0.05-1.0 wt.% Cr, 0.4-1.2 wt.% Mo, 0.05-0.10 wt.% Ti and 0.02-0.35 wt.% V. A compositional overlap with the claimed composition is, therefore, very narrow. None of the exemplified steels in the patent document discloses a steel falling within the claimed range. The claimed compositional

International application No. PCT/GB98/02526 INTERNATIONAL PRELIMINARY **EXAMINATION REPORT - SEPARATE SHEET**

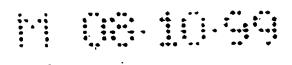
limitation alleges an improvement in the thermal fatigue and wear resistance. Hence the claimed rotor composition must be considered a novel selection.

4. Inventive step. Art.33(3)

The selection of a brake rotor comprising a grey cast iron with the compositional limitations of claim 1 convincingly solves the problem of wear resistance and thermal fatigue, assuming that the term "hard carbide forming metals" consists of at least one of the group of tungsten, chromium, molybdenum and niobium as well as both of titanium and vanadium (see item 2 above). The solution provided is not considered obvious for the skilled man. Without such a limitation however, it would not be possible to foresee whether the aims of the invention could be achieved.

Industrial applicability, Art.33(4). 5.

The subject matter of the claims is deemed industrially applicable.



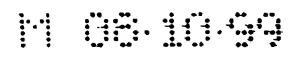
0.2-0.8 wt% niobium and 0.3-0.5 wt% copper. However, alloying has a detrimental effect on thermal conductivity.

In addition to thermal and mechanical considerations, a material for a disc brake rotor must exhibit good wear resistance. In an unalloyed iron, wear resistance is primarily a function of the matrix structure and its hardness. Alloying the iron can create carbides so that wear resistance becomes more a function of the properties of the carbides. However, when vanadium, titanium and chromium are added to iron in excess quantities, a fall in the strength occurs arising from the formation of intergranular carbides in the matrix. Carbide stabilising elements such as chromium, molybdenum and vanadium also increase the tendency for the formation of free ferrite which is detrimental to the strength and tribological properties. For this reason, these elements are normally used at levels which are below those at which free carbides are formed so that the wear benefits of free carbides are not obtained. It is also considered that the use of high alloy structures containing free carbides would cause the formation of "hot spots" resulting in brake judder and heat cracking,

The present invention has the object of further increasing the thermal fatigue and wear resistance properties of a disc brake rotor.

The invention provides a disc brake rotor having a grey cast iron composition, characterised in that said composition comprises between 0.5 and 1.2% by weight of copper, and a plurality of hard carbide forming matals including both vanadium and titanium, the ratio between the weight of copper present and the total weight of said hard carbide forming metals being 1.8 to 3 units of copper to 1 unit of the hard carbide forming metals.

AMENDED SHEET



CLAIMS

- A disc brake rotor having a grey cast iron composition, characterised in that said composition comprises between 0.5 and 1.2% by weight of copper, and a plurality of hard carbide forming metals including both vanadium and titanium, the ratio between the weight of copper present and the total weight of said hard carbide forming metals being 1.8 to 3 units of copper to 1 unit of the hard carbide forming metals.
- A disc brake rotor according to claim 1, characterised in that the hard carbide forming metals also include one or more of tungsten, molybdenum, chromium, and niobium.
- A disc brake rotor according to either one of claims 1 and 2, characterised in that the weight of vanadium present in the composition is less than or equal to one half of the weight of copper present added to 20 times the weight of titanium present.
- A disc brake rotor according to any one of claims 1 to 3, characterised in that the carbon equivalent of the composition is between 4.2 and 4.55.
- 5 A disc brake rotor according to any one of claims 1 to 4, characterised in that the titanium content of the composition is between 0.025 and 0.035 wt%.
- 6 A disc brake rotor according to any one of claims 1 to 5, characterised in that the vanadium content of the composition is between 0.35 and 0.45 Vt%.

AMENDED SHEET

This Page Is Inserted by IFW Operations and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES



- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents will not correct images, please do not report the images to the Image Problem Mailbox.